



## SEQUENCE LISTING

<110> ID-Lelystad, Instituut voor Dierhouderij en Diergezondheid B.V.  
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Zijderveld van, Fred G.  
Thole, Jelle E.R.

<120> Paramycobacterial diagnostics and vaccines

<130> P54977PC00

<140> PCT/NL03/00020

<141> 2003-01-13

<150> EP 02075089.9

<151> 2002-01-11

<160> 22

<170> PatentIn Ver. 2.1

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<212> DNA

<213> Mycobacterium avium paratuberculosis

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<223> Description of Combined DNA/RNA Molecule:  
immunogenic protein of M. avium paratuberculosis

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<221> CDS

<222> (134)..(1144)

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1 5 10

atg agc gcg gtc gcc gcc ctg gca gtg gcg agt cct tgc gca tac ttc 217  
Met Ser Ala Val Ala Ala Leu Ala Val Ala Ser Pro Cys Ala Tyr Phe  
15 20 25

ctt gtc tac gaa tcg acg gcc ggc aac aag gcg ccc gag cac cac gag 265  
Leu Val Tyr Glu Ser Thr Ala Gly Asn Lys Ala Pro Glu His His Glu  
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ttc aag cag gcc gca gtg atg agc gat ctg ccg ggc gag ctg atg ggt 313  
Phe Lys Gln Ala Ala Val Met Ser Asp Leu Pro Gly Glu Leu Met Gly  
45 50 55 60

gcg ctg tcg cag ggc ctg tcg cag ttt ggg atc aac ctg ccc ccg gtg 361  
Ala Leu Ser Gln Gly Leu Ser Gln Phe Gly Ile Asn Leu Pro Pro Val  
65 70 75

ccc gcc ctg agc ggc ggc gcc acc agc act ccc ggt ctg gcc agc ccc 409  
Pro Ala Leu Ser Gly Gly Ala Thr Ser Thr Pro Gly Leu Ala Ser Pro  
80 85 90

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Gly	Leu	Gly	Ser	Pro	Gly	Leu	Gly	Thr	Pro	Gly	Leu	Gly	Thr	Pro	Gly	
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Thr	Ser	Pro	Gly	Leu	Thr	Ser	Pro	Gly	Leu	Thr	Ser	Pro	Gly	Leu	Thr	
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Ser	Pro	Gly	Ala	Ala	Pro	Thr	Thr	Pro	Gly	Leu	Thr	Ala	Pro	Gly	Ala	
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Asn	Pro	Ala	Leu	Ser	Asn	Pro	Gly	Leu	Thr	Ser	Pro	Ala	Gly	Thr	Ala	
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ccg	ggg	ctg	ggc	agc	ccg	acc	gtg	gcg	ccg	agt	gag	gtg	ccg	atc	gac	745
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Ser	Gly	Ala	Gly	Leu	Asp	Pro	Gly	Ala	Gly	Gly	Thr	Tyr	Pro	Ile	Leu	
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Gly	Gly	Ala	Ala	Ala	Gly	Ala	Leu	Pro	Gly	Ala	Ala	Gly	Ala	Leu	Pro	
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 <213> Mycobacterium avium paratuberculosis

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 <223> Description of Combined DNA/RNA Molecule:  
 immunogenic protein of M. avium paratuberculosis

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 35 40 45  
 Ala Val Met Ser Asp Leu Pro Gly Glu Leu Met Gly Ala Leu Ser Gln  
 50 55 60  
 Gly Leu Ser Gln Phe Gly Ile Asn Leu Pro Pro Val Pro Ala Leu Ser  
 65 70 75 80  
 Gly Gly Ala Thr Ser Thr Pro Gly Leu Ala Ser Pro Gly Leu Gly Ser  
 85 90 95  
 Pro Gly Leu Gly Thr Pro Gly Leu Gly Thr Pro Gly Leu Thr Asn Pro  
 100 105 110  
 Gly Leu Thr Ser Pro Gly Ala Thr Ser Pro Gly Leu Thr Ser Pro Gly  
 115 120 125  
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 130 135 140  
 Ala Pro Thr Thr Pro Gly Leu Thr Ala Pro Gly Ala Leu Pro Thr Thr  
 145 150 155 160  
 Pro Gly Gly Gly Val Ala Thr Pro Gly Ala Gly Leu Asn Pro Ala Leu  
 165 170 175  
 Ser Asn Pro Gly Leu Thr Ser Pro Ala Gly Thr Ala Pro Gly Leu Gly  
 180 185 190  
 Ser Pro Thr Val Ala Pro Ser Glu Val Pro Ile Asp Ser Gly Ala Gly  
 195 200 205  
 Leu Asp Pro Gly Ala Gly Gly Thr Tyr Pro Ile Leu Gly Asp Pro Ser  
 210 215 220  
 Thr Phe Gly Asn Ala Ser Pro Ile Gly Gly Gly Thr Gly Leu Gly  
 225 230 235 240  
 Gly Gly Ser Ser Ser Gly Gly Ser Gly Gly Leu Val Asn Asp Val Met  
 245 250 255  
 Gln Ala Ala Asn Gln Leu Gly Ala Gly Gln Ala Ile Asp Leu Leu Lys  
 260 265 270  
 Gly Leu Val Met Pro Ala Ile Thr Gln Gly Met His Gly Gly Ala Ala  
 275 280 285  
 Ala Gly Ala Leu Pro Gly Ala Ala Gly Ala Leu Pro Gly Ala Ala Gly  
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<222> (67)..(567)

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Ala Phe Ala Val Ala Leu Leu Leu Gly Leu Gly Asp Val Pro Arg Ala
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Ala Ala Thr Asp Asp Arg Leu Gln Phe Thr Ala Thr Thr Leu Ser Gly
35           40           45
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Ala Pro Phe Asn Gly Ala Ser Leu Gln Gly Lys Pro Ala Val Leu Trp
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Phe Trp Thr Pro Trp Cys Pro Tyr Cys Asn Ala Glu Ala Pro Gly Val
65           70           75
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Ser Arg Val Ala Ala Ala Asn Pro Gly Val Thr Phe Val Gly Val Ala
80           85           90
gcc cac tcc gaa gtc ggc gcc atg gcc aac ttc gtc tcc aag tac aac 396
Ala His Ser Glu Val Gly Ala Met Ala Asn Phe Val Ser Lys Tyr Asn
95           100           105
ctg aac ttc acc acg ctc aac gac gcc gac ggc gcg atc tgg gcc cgc 444
Leu Asn Phe Thr Thr Leu Asn Asp Ala Asp Gly Ala Ile Trp Ala Arg
115           120           125
tac ggc gtg ccc tgg cag ccc gcg tac gtg ttc tac cgg gcg gac ggc 492
Tyr Gly Val Pro Trp Gln Pro Ala Tyr Val Phe Tyr Arg Ala Asp Gly
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145           150           155
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<213> Mycobacterium avium paratuberculosis

<220>

<223> Description of Combined DNA/RNA Molecule:  
immunogenic protein of M. avium paratuberculosis

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35 40 45  
Phe Asn Gly Ala Ser Leu Gln Gly Lys Pro Ala Val Leu Trp Phe Trp  
50 55 60  
Thr Pro Trp Cys Pro Tyr Cys Asn Ala Glu Ala Pro Gly Val Ser Arg  
65 70 75 80  
Val Ala Ala Ala Asn Pro Gly Val Thr Phe Val Gly Val Ala Ala His  
85 90 95  
Ser Glu Val Gly Ala Met Ala Asn Phe Val Ser Lys Tyr Asn Leu Asn  
100 105 110  
Phe Thr Thr Leu Asn Asp Ala Asp Gly Ala Ile Trp Ala Arg Tyr Gly  
115 120 125  
Val Pro Trp Gln Pro Ala Tyr Val Phe Tyr Arg Ala Asp Gly Ser Ser  
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immunogenic protein of M. avium paratuberculosis

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<222> (34)..(366)

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Leu Gly Val Ala Val Gly Ser Ala Ala Val Ala Leu Thr Ala Ala Ala  
10 15 20  
ggg gtc gca tcc gcc gac ccc atg gac gcg atc atc aac acc acc tgc 150  
Gly Val Ala Ser Ala Asp Pro Met Asp Ala Ile Ile Asn Thr Thr Cys  
25 30 35  
aac tac ggg cag gtg atc gcc gcg ctg aac gcg tcc gac ccg gcg gct 198  
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Asn Tyr Gly Gln Val Ile Ala Ala Leu Asn Ala Ser Asp Pro Ala Ala  
 40 45 50 55  
 gcc cag cag ctg aac tcg tcg ccg atg gcg cag tcc tac atc cag cgg 246  
 Ala Gln Gln Leu Asn Ser Ser Pro Met Ala Gln Ser Tyr Ile Gln Arg  
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 Phe Leu Ala Ser Pro Pro Ala Lys Arg Gln Gln Met Ala Gln Gln Ile  
 75 80 85  
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 Gln Gly Met Pro Ala Ala Gln Gln Tyr Ile Asn Asp Ile Asn Gln Val  
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 immunogenic protein of M. avium paratuberculosis

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 Asn Ala Ser Asp Pro Ala Ala Ala Gln Gln Leu Asn Ser Ser Pro Met  
 50 55 60  
 Ala Gln Ser Tyr Ile Gln Arg Phe Leu Ala Ser Pro Pro Ala Lys Arg  
 65 70 75 80  
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atc Ile 230	gcc Ala	gag Glu	gtg Val	ttc Phe	gcc Ala	cgc Arg 235	gac Asp	ggc Gly	gcc Ala	cgc Arg	gtg Val 240	gtc Val	gcg Ala	atc Ile	gac Asp	777
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ggc acc gcg ctg tgg ctc gac gtc acc gcc ccc gac gcc gtc gac aag	873
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Ile Thr Glu His 280 Leu Arg Glu His 285 His Gly Gly His Ala 290 Asp Ile Leu	
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Val Asn Asn 295 Ala Gly Ile Thr 300 Arg Asp Lys Leu Leu 305 Ala Asn Met Asp	
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Asp Ala Arg Trp Asp Ala Val 315 Leu Ala Val Asn 320 Leu Leu Ala Pro Leu	
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Arg Ile Val Gly 345 Leu Ser Ser Met Ala 350 Gly Ile Ala Gly Asn 355 Arg Gly	
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Ala Leu 375 Pro Glu Leu Tyr 380 Asp Lys Gly Ile Thr 385 Ile Asn Ala Val	
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Thr Arg Glu Val Gly 410 Arg Arg Met Asn Ser 415 Leu Leu Gln Gly Gly 420 Gln	
ccg gtg gac gtc gcc gaa acc atc gcc tac ttc gcc agc ccg gcg tcg	1353
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<210> 8

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<212> PRT

<213> Mycobacterium avium paratuberculosis

<220>

<223> Description of Combined DNA/RNA Molecule:  
immunogenic protein of M. avium paratuberculosis

<400> 8



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 Thr Leu Arg Arg<sub>35</sub> Tyr Arg Pro Gly<sub>40</sub> Asp Pro Pro Leu Ala<sub>45</sub> Gly Ser Leu  
 Leu Ile Gly Gly Glu Gly Arg<sub>55</sub> Val Val Glu Pro Leu Arg Ala Ala Leu  
 Ala Lys Asp Tyr Asp<sub>65</sub> Leu Val Gly Asn Asn Leu<sub>70</sub> Gly Gly Arg Trp Ala  
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 Ala Asn Met Asp Asp<sub>180</sub> Ala Arg Trp Asp Ala Val Leu Ala Val Asn Leu  
 Leu Ala Pro Leu Arg<sub>185</sub> Leu Thr Glu Gly Leu Val Gly Asn Gly Ser Ile  
 Gly Glu Gly Gly Arg Ile Val Gly Leu Ser Ser Met Ala Gly Ile Ala  
 Gly Asn Arg Gly Gln Thr Asn Tyr<sub>190</sub> Ala Thr Thr Lys Ala Gly Met Ile  
 Gly Leu Thr Gln Ala Leu Ala Pro Gly Phe Ile Glu Thr Gln Met Thr Ala Ala  
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 Ile Pro Leu Ala Thr Arg<sub>200</sub> Glu Val Gly Arg Arg Met Asn Ser Leu Leu  
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<213> Mycobacterium avium paratuberculosis

<220>

<223> Description of Combined DNA/RNA Molecule:  
immunogenic protein of M. avium paratuberculosis

<220>

<221> CDS

<222> (179)..(625)

<223> /note="Xaa at location 95 stands for Gln or His,  
at location 118 stands for Gly or Arg, at location  
147 stands for stop codon, Trp or Cys"

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aattcgcgca tacccgtcac tggtcacaac gccacatgct ggtaggctgt ggaatcgagg 60
gtcaatccgg atcggacccc aacgtcgact tgtgggcgcc aattcgcggg ttttcgccca 120
gcaagtcgac gttcggcgcg aatcgggtgag gtgggcacag gtgaatgacg aagaggac 178
atg ctg gtc gcc acg gtg cgg gcg ttc atc gac cgc gag gtc aaa ccg 226
Met Leu Val Ala Thr Val Arg Ala Phe Ile Asp Arg Glu Val Lys Pro
  1          5          10          15
acc gtg cgc gag gtg gag cac gcc gat gcc tat ccc gag gcg tgg atc 274
Thr Val Arg Glu Val Glu His Ala Asp Ala Tyr Pro Glu Ala Trp Ile
          20          25          30
gag cag atg aag cgg atc ggg atc tac ggg ctg gcg gtg ccc gag gaa 322
Glu Gln Met Lys Arg Ile Gly Ile Tyr Gly Leu Ala Val Pro Glu Glu
          35          40          45
tac ggt ggt tcg ccg gtg tcc atg ccg tgc tac gtg cgg gtc acc gag 370
Tyr Gly Gly Ser Pro Val Ser Met Pro Cys Tyr Val Arg Val Thr Glu
          50          55          60
cag ctg gcg cgc ggc tgg atg agc ctg gcc ggg gcg atg ggc ggg cac 418
Gln Leu Ala Arg Gly Trp Met Ser Leu Ala Gly Ala Met Gly Gly His
          65          70          75          80
acc gtg gtg gcc aag ctg cta acg ctg ttc ggc acc gag gac cas aag 466
Thr Val Val Ala Lys Leu Leu Thr Leu Phe Gly Thr Glu Asp Xaa Lys
          85          90          95
cgg gcc tac ctg ccg cgg atg gcc agc ggc gaa atc cgg gcc acc atg 514
Arg Ala Tyr Leu Pro Arg Met Ala Ser Gly Glu Ile Arg Ala Thr Met
          100          105          110
gcg ttg acc gag ccc sgc ggc ggc tcg gac ctg cag aac atg tcg acc 562
Ala Leu Thr Glu Pro Xaa Gly Gly Ser Asp Leu Gln Asn Met Ser Thr
          115          120          125
acc gcg ctg ccc gac ccc gac tcc gac ggn ctg gtg gtc aac ggg gcc 610
Thr Ala Leu Pro Asp Pro Asp Ser Asp Xaa Leu Val Val Asn Gly Ala
          130          135          140
aag acc tgn atc aac
Lys Thr xaa Ile Asn 625
145
```

<210> 10

<211> 149

<212> PRT

<213> Mycobacterium avium paratuberculosis

<220>

<223> Description of Combined DNA/RNA Molecule:  
immunogenic protein of M. avium paratuberculosis

<220>

<221> CDS

<222> (95)..(147)

<223> /note="Xaa at location 95 stands for Gln or His,  
at location 118 stands for Gly or Arg, at location  
147 stands for stop codon, Trp or Cys"

<400> 10

Met Leu Val Ala Thr Val Arg Ala Phe Ile Asp Arg Glu Val Lys Pro  
1 5 10 15

Thr Val Arg Glu Val Glu His Ala Asp Ala Tyr Pro Glu Ala Trp Ile  
20 25 30

Glu Gln Met Lys Arg Ile Gly Ile Tyr Gly Leu Ala Val Pro Glu Glu  
35 40 45

Tyr Gly Gly Ser Pro Val Ser Met Pro Cys Tyr Val Arg Val Thr Glu  
50 55 60

Gln Leu Ala Arg Gly Trp Met Ser Leu Ala Gly Ala Met Gly Gly His  
65 70 75 80

Thr Val Val Ala Lys Leu Leu Thr Leu Phe Gly Thr Glu Asp Xaa Lys  
85 90 95

Arg Ala Tyr Leu Pro Arg Met Ala Ser Gly Glu Ile Arg Ala Thr Met  
100 105 110

Ala Leu Thr Glu Pro Xaa Gly Gly Ser Asp Leu Gln Asn Met Ser Thr  
115 120 125

Thr Ala Leu Pro Asp Pro Asp Ser Asp Xaa Leu Val Val Asn Gly Ala  
130 135 140

Lys Thr Xaa Ile Asn  
145

<210> 11

<211> 241

<212> DNA

<213> Mycobacterium avium paratuberculosis

<220>

<223> Description of Combined DNA/RNA Molecule:  
immunogenic protein of M. avium paratuberculosis

<220>

<221> CDS

<222> (147)..(239)

<400> 11

gtgggggcaa gccaattacg ttgcgcatcga cccggcacag gcggtcgctc acgtcatcaa 60

catgccgctc atccccgatg aggtctcgaat gaccttgcta cgcaggcgct gaacgcacga 120

cgaaacggac cggaggtgaa agggac atg agc cac gcc gat caa ctc gct cgg 173  
Met Ser His Ala Asp Gln Leu Ala Arg  
1 5

acg cac ctg gcg ccc gat cct gcg gac ctg tcg cgc ctg gtc gcc ggc 221  
Thr His Leu Ala Pro Asp Pro Ala Asp Leu Ser Arg Leu Val Ala Gly  
10 15 20 25

acc cac cac gac ccg cac gg 241  
Thr His His Asp Pro His  
30

<210> 12

<211> 31

<212> PRT

<213> Mycobacterium avium paratuberculosis

<220>

<223> Description of Combined DNA/RNA Molecule:  
immunogenic protein of M. avium paratuberculosis

<400> 12

Met Ser His Ala Asp Gln Leu Ala Arg Thr His Leu Ala Pro Asp Pro  
1 5 10 15

Ala Asp Leu Ser Arg Leu Val Ala Gly Thr His His Asp Pro His  
20 25 30

<210> 13

<211> 236

<212> DNA

<213> Mycobacterium avium paratuberculosis

<220>

<223> Description of Combined DNA/RNA Molecule:  
immunogenic protein of M. avium paratuberculosis

<220>

<221> CDS

<222> (8)..(214)

<400> 13

ggacacc aac gtg acc ggg gtg ttt ctc acc gcc cag gcg gcg gcc cgg 49  
Asn Val Thr Gly Val Phe Leu Thr Ala Gln Ala Ala Ala Arg  
1 5 10

gcg atg atg cgg cag ggc cgc ggc ggc gcc atc atc acc acc gcc tcg 97  
Ala Met Met Arg Gln Gly Arg Gly Gly Ala Ile Ile Thr Thr Ala Ser  
15 20 25 30

atg tcc ggg cac atc atc aac gtc ccg cag cag gtc ggc cac tac tgc 145  
Met Ser Gly His Ile Ile Asn Val Pro Gln Gln Val Gly His Tyr Cys  
35 40 45

gcc agc aag gcg gcc gtg atc cag ctg acc aag gcc atg gcc gtc gaa 193  
Ala Ser Lys Ala Ala Val Ile Gln Leu Thr Lys Ala Met Ala Val Glu  
50 55 60

ttc tgc agg atc cgt cga ctc tagactcgag caagcttatg ca 236  
Phe Cys Arg Ile Arg Arg Leu  
65

<210> 14  
 <211> 69  
 <212> PRT  
 <213> Mycobacterium avium paratuberculosis

<220>  
 <223> Description of Combined DNA/RNA Molecule:  
 immunogenic protein of M. avium paratuberculosis

<400> 14  
 Asn Val Thr Gly Val Phe Leu Thr Ala Gln Ala Ala Ala Arg Ala Met  
     1                    5                    10                    15  
 Met Arg Gln Gly Arg Gly Gly Ala Ile Ile Thr Thr Ala Ser Met Ser  
                     20                    25                    30  
 Gly His Ile Ile Asn Val Pro Gln Gln Val Gly His Tyr Cys Ala Ser  
                     35                    40                    45  
 Lys Ala Ala Val Ile Gln Leu Thr Lys Ala Met Ala Val Glu Phe Cys  
                     50                    55                    60  
 Arg Ile Arg Arg Leu  
     65

<210> 15  
 <211> 419  
 <212> DNA  
 <213> Mycobacterium avium paratuberculosis

<220>  
 <223> Description of Combined DNA/RNA Molecule:  
 immunogenic protein of M. avium paratuberculosis

<220>  
 <221> CDS  
 <222> (25)..(417)  
 <223> /note="Xaa at location 103 stands for Met, Val or  
 Leu, Xaa at location 125 stands for Lys, Arg, Thr  
 or Met"

<400> 15  
 cggccaccgc acccagggga ggcc atg act cac acc aag gcc ggt cgt gcc 51  
                                     Met Thr His Thr Lys Ala Gly Arg Ala  
                                     1                    5  
 gcg tgg ccg gcc gcc tgc gcg gtc gtc ctg tcc gcc gcc gcg ctg ttg 99  
 Ala Trp Pro Ala Ala Cys Ala Val Val Leu Ser Ala Ala Ala Leu Leu  
     10                    15                    20                    25  
 tgc gcg gca gcg gcc gcc gcg gac gaa gcc gat gac gcg ttc ctc gcc 147  
 Cys Ala Ala Ala Ala Ala Ala Asp Glu Ala Asp Asp Ala Phe Leu Ala  
                     30                    35                    40  
 ggc ctg gcc aag ggc ggg atc acc atg ttc gac gac gac gac gcg atc 195  
 Gly Leu Ala Lys Gly Gly Ile Thr Met Phe Asp Asp Asp Asp Ala Ile  
                     45                    50                    55  
 gcc atg ggc cac agc gtg tgc tcg agc atc gac gcc aac ccc aac gtg 243  
 Ala Met Gly His Ser Val Cys Ser Ser Ile Asp Ala Asn Pro Asn Val  
                                     13

60	65	70	
tcg atg ctg gcg ctg cgg ctg acc aag caa acc ccg ttg acg ccg aag			291
Ser Met Leu Ala Leu Arg Leu Thr Lys Gln Thr Pro Leu Thr Pro Lys			
75	80	85	
caa tcc ggc tac ttc atc ggt ctt tcg gtc gcc agc tac ntg ccc gca			339
Gln Ser Gly Tyr Phe Ile Gly Leu Ser Val Ala Ser Tyr Xaa Pro Ala			
90	95	100	105
gta caa gga cga cgt cga ccc ctc gct ggg ctg gct gat ccc gcc gcc			387
Val Gln Gly Arg Arg Pro Leu Ala Gly Leu Ala Asp Pro Ala Ala			
	110	115	120
gct gat gtg ang ttg ccg gcc ggc atc ggc gt			419
Ala Asp Val Xaa Leu Pro Ala Gly Ile Gly			
	125	130	

<210> 16

<211> 131

<212> PRT

<213> Mycobacterium avium paratuberculosis

<220>

<223> Description of Combined DNA/RNA Molecule:  
immunogenic protein of M. avium paratuberculosis

<220>

<221> CDS

<222> (103)..(125)

<223> /note="Xaa at location 103 stands for Met, Val or  
Leu, Xaa at location 125 stands for Lys, Arg, Thr  
or Met"

<400> 16

Met Thr His Thr Lys Ala Gly Arg Ala Ala Trp Pro Ala Ala Cys Ala

1

5

10

15

Val Val Leu Ser Ala Ala Ala Leu Leu Cys Ala Ala Ala Ala Ala Ala

20

25

30

Asp Glu Ala Asp Asp Ala Phe Leu Ala Gly Leu Ala Lys Gly Gly Ile

35

40

45

Thr Met Phe Asp Asp Asp Asp Ala Ile Ala Met Gly His Ser Val Cys

50

55

60

Ser Ser Ile Asp Ala Asn Pro Asn Val Ser Met Leu Ala Leu Arg Leu

65

70

75

80

Thr Lys Gln Thr Pro Leu Thr Pro Lys Gln Ser Gly Tyr Phe Ile Gly

85

90

95

Leu Ser Val Ala Ser Tyr Xaa Pro Ala Val Gln Gly Arg Arg Arg Pro

100

105

110

Leu Ala Gly Leu Ala Asp Pro Ala Ala Ala Asp Val Xaa Leu Pro Ala

115

120

125

Gly Ile Gly

130







gac Asp 110	atc Ile	acc Thr	gac Asp	gcg Ala	gtc Val 115	atc Ile	acc Thr	gta Val	ccg Pro	gcg Ala 120	tac Tyr	ttc Phe	aac Asn	gac Asp	gcc Ala 125	387
cag Gln	cgt Arg	cag Gln	gcg Ala	acc Thr 130	aag Lys	gaa Glu	gcc Ala	ggc Gly	cag Gln 135	atc Ile	gcc Ala	ggc Gly	ctc Leu	aac Asn 140	gtg Val	435
ctg Leu	cgc Arg	atc Ile	gtc Val 145	aac Asn	gag Glu	ccg Pro	acc Thr	gcg Ala 150	gcc Ala	gcg Ala	ctg Leu	gcc Ala	tac Tyr 155	ggc Gly	ctg Leu	483
gac Asp	aag Lys	ggc Gly 160	gag Glu	aag Lys	gag Glu	cag Gln	acc Thr 165	atc Ile	ctg Leu	gtc Val	ttc Phe	gac Asp 170	ctc Leu	ggc Gly	ggc Gly	531
ggc Gly	acg Thr 175	ttc Phe	gac Asp	gtt Val	tcg Ser	ctg Leu 180	ctc Leu	gag Glu	atc Ile	ggc Gly 185	gag Glu	ggt Gly	gtg Val	gtc Val	gag Glu	579
gtc Val 190	cgc Arg	gcc Ala	acc Thr	agc Ser	ggt Gly 195	gac Asp	aac Asn	caa Gln	ctc Leu	ggt Gly 200	ggc Gly	gac Asp	gac Asp	tgg Trp	gac Asp 205	627
gac Asp	cgg Arg	atc Ile	gtc Val	aac Asn 210	tgg Trp	ctg Leu	gtc Val	gac Asp	aag Lys 215	ttc Phe	aag Lys	ggc Gly	acc Thr 220	agc Ser	ggc Gly	675
atc Ile	gac Asp	ctg Leu	acc Thr 225	aag Lys	gac Asp	aag Lys	atg Met	gcc Ala 230	atg Met	cag Gln	cgg Arg	ctg Leu	cgt Arg 235	gag Glu	gcc Ala	723
gcc Ala	gag Glu	aag Lys 240	gcc Ala	aag Lys	atc Ile	gag Glu 245	ttg Leu	tcc Ser	agc Ser	tcg Ser	cag Gln	agc Ser 250	acc Thr	tcg Ser	atc Ile	771
aac Asn 255	ctg Leu	ccc Pro	tac Tyr	atc Ile	acc Thr	gtc Val 260	gac Asp	gcg Ala	gac Asp	aag Lys	aac Asn 265	ccg Pro	ctg Leu	ttc Phe	ctc Leu	819
gac Asp 270	gag Glu	cag Gln	ctg Leu	acc Thr	cgc Arg 275	gcc Ala	gaa Glu	ttc Phe	cag Gln	cgc Arg 280	atc Ile	acc Thr	cag Gln	gat Asp	ctg Leu 285	867
ctg Leu	gac Asp	cgc Arg	acc Thr	cgt Arg 290	cag Gln	ccg Pro	ttc Phe	aag Lys	tcg Ser 295	gtg Val	atc Ile	gcc Ala	gac Asp	gcc Ala 300	ggc Gly	915
atc Ile	tcg Ser	gtg Val	tcc Ser 305	gac Asp	atc Ile	gac Asp	cac His	gtg Val 310	gtg Val	ctg Leu	gtg Val	ggt Gly 315	ggt Gly	tcc Ser	acc Thr	963
cgg Arg	atg Met	ccc Pro 320	gcg Ala	gtg Val	acc Thr	gac Asp	ctg Leu 325	gtc Val	aag Lys	gaa Glu	ctc Leu	acc Thr 330	ggc Gly	ggc Gly	aag Lys	1011
gag Glu 335	ccc Pro	aac Asn	aag Lys	ggc Gly	gtc Val	aac Asn 340	ccc Pro	gac Asp	gag Glu	gtt Val	gtc Val 345	gcg Ala	gtg Val	ggt Gly	gcc Ala	1059
gcc Ala 350	ctg Leu	cag Gln	gcc Ala	ggt Gly	gtg Val 355	ctt Leu	aag Lys	ggc Gly	gag Glu	gtg Val 360	aaa Lys	gac Asp	gtt Val	ctg Leu	ctg Leu 365	1107

ctt	gac	gtt	acg	ccg	ctg	agc	ctg	ggt	atc	gag	acc	aag	ggt	ggc	gtg	1155
Leu	Asp	Val	Thr	Pro	Leu	Ser	Leu	Gly	Ile	Glu	Thr	Lys	Gly	Gly	Val	
				370				375					380			
atg	acc	aag	ctg	atc	gaa	cgc	aac	acc	acc	atc	ccg	acc	aag	cgg	tcc	1203
Met	Thr	Lys	Leu	Ile	Glu	Arg	Asn	Thr	Thr	Ile	Pro	Thr	Lys	Arg	Ser	
			385					390					395			
gag	acg	ttc	acc	acg	gcc	gac	gac	aac	cag	ccg	tcg	gtg	cag	atc	cag	1251
Glu	Thr	Phe	Thr	Thr	Ala	Asp	Asp	Asn	Gln	Pro	Ser	Val	Gln	Ile	Gln	
		400					405					410				
gtg	tat	cag	ggt	gag	cgc	gaa	atc	gcc	gcg	cac	aac	aag	ctg	ctc	ggc	1299
Val	Tyr	Gln	Gly	Glu	Arg	Glu	Ile	Ala	Ala	His	Asn	Lys	Leu	Leu	Gly	
	415					420					425					
tcc	ttc	gag	ctg	acc	gga	att	ccg	ccg	gcg	ccc	cgc	ggc	gtg	ccg	cag	1347
Ser	Phe	Glu	Leu	Thr	Gly	Ile	Pro	Pro	Ala	Pro	Arg	Gly	Val	Pro	Gln	
					435					440					445	
atc	gag	gtc	acc	ttc	gac	atc	gac	gcc	aac	ggc	atc	gtg	cac	gtc	acc	1395
Ile	Glu	Val	Thr	Phe	Asp	Ile	Asp	Ala	Asn	Gly	Ile	Val	His	Val	Thr	
				450				455						460		
gcc	aag	gac	aag	ggc	acc	ggt	aag	gag	aac	acg	atc	aag	atc	cag	gag	1443
Ala	Lys	Asp	Lys	Gly	Thr	Gly	Lys	Glu	Asn	Thr	Ile	Lys	Ile	Gln	Glu	
			465					470					475			
ggc	tcc	ggc	ctg	tcc	aag	gag	gag	atc	gac	cgg	atg	atc	aag	gac	gcc	1491
Gly	Ser	Gly	Leu	Ser	Lys	Glu	Glu	Ile	Asp	Arg	Met	Ile	Lys	Asp	Ala	
		480				485					490					
gag	gcg	cac	gcc	gag	gag	gac	cgc	aag	agg	cgc	gag	gaa	gcc	gac	gtc	1539
Glu	Ala	His	Ala	Glu	Glu	Asp	Arg	Lys	Arg	Arg	Glu	Glu	Ala	Asp	Val	
	495					500					505					
cgc	aac	caa	gcg	gaa	tcg	ctt	gtc	tac	cag	acg	gag	aag	ttc	gtc	aag	1587
Arg	Asn	Gln	Ala	Glu	Ser	Leu	Val	Tyr	Gln	Thr	Glu	Lys	Phe	Val	Lys	
	510				515					520					525	
gac	cag	cgc	gag	gcc	gag	ggc	ggc	tcg	aag	gtt	ccc	gag	gag	acg	ctg	1635
Asp	Gln	Arg	Glu	Ala	Glu	Gly	Gly	Ser	Lys	Val	Pro	Glu	Glu	Thr	Leu	
				530					535					540		
tcc	aag	gtc	gac	gcc	gcg	atc	gcc	gac	gcc	aag	acg	gcc	ctg	ggc	ggc	1683
Ser	Lys	Val	Asp	Ala	Ala	Ile	Ala	Asp	Ala	Lys	Thr	Ala	Leu	Gly	Gly	
			545					550					555			
acc	gac	atc	acc	gcg	atc	aag	tcg	gcg	atg	gag	aag	ctc	ggc	cag	gag	1731
Thr	Asp	Ile	Thr	Ala	Ile	Lys	Ser	Ala	Met	Glu	Lys	Leu	Gly	Gln	Glu	
		560					565					570				
tcg	caa	gcg	ctg	gga	cag	gca	atc	tac	gag	gcc	acc	cag	gcc	gag	tcc	1779
Ser	Gln	Ala	Leu	Gly	Gln	Ala	Ile	Tyr	Glu	Ala	Thr	Gln	Ala	Glu	Ser	
	575					580					585					
gcc	cag	gct	ggc	ggg	ccg	gac	ggt	gcc	gcg	gcc	ggc	ggc	ggg	tcc	gga	1827
Ala	Gln	Ala	Gly	Gly	Pro	Asp	Gly	Ala	Ala	Ala	Gly	Gly	Gly	Ser	Gly	
	590				595					600					605	
tcc	gcc	gac	gat	gtt	gtg	gac	gcg	gag	gtg	gtc	gac	gat	gac	cgg	gag	1875
Ser	Ala	Asp	Asp	Val	Val	Asp	Ala	Glu	Val	Val	Asp	Asp	Asp	Arg	Glu	
				610					615					620		

tcc aag tga  
Ser Lys

1884

<210> 20  
<211> 623  
<212> PRT  
<213> Mycobacterium avium paratuberculosis

<220>  
<223> Description of Combined DNA/RNA Molecule:  
immunogenic protein of M. avium paratuberculosis

<400> 20  
Met Ala Arg Ala Val Gly Ile Asp Leu Gly Thr Thr Asn Ser Val Val  
1 5 10 15  
Ala Val Leu Glu Gly Gly Asp Pro Val Val Ala Asn Ser Glu Gly  
20 25 30  
Ser Arg Thr Thr Pro Ser Ile Val Ala Phe Ala Arg Asn Gly Glu Val  
35 40 45  
Leu Val Gly Gln Pro Ala Lys Asn Gln Ala Val Thr Asn Val Asp Arg  
50 55 60  
Thr Ile Arg Ser Val Lys Arg His Met Gly Thr Asp Trp Ser Ile Glu  
65 70 75 80  
Ile Asp Gly Lys Lys Tyr Thr Ala Gln Glu Ile Ser Ala Arg Val Leu  
85 90 95  
Met Lys Leu Lys Arg Asp Ala Glu Ala Tyr Leu Gly Glu Asp Ile Thr  
100 105 110  
Asp Ala Val Ile Thr Val Pro Ala Tyr Phe Asn Asp Ala Gln Arg Gln  
115 120 125  
Ala Thr Lys Glu Ala Gly Gln Ile Ala Gly Leu Asn Val Leu Arg Ile  
130 135 140  
Val Asn Glu Pro Thr Ala Ala Ala Leu Ala Tyr Gly Leu Asp Lys Gly  
145 150 155 160  
Glu Lys Glu Gln Thr Ile Leu Val Phe Asp Leu Gly Gly Gly Thr Phe  
165 170 175  
Asp Val Ser Leu Leu Glu Ile Gly Glu Gly Val Val Glu Val Arg Ala  
180 185 190  
Thr Ser Gly Asp Asn Gln Leu Gly Gly Asp Asp Trp Asp Asp Arg Ile  
195 200 205  
Val Asn Trp Leu Val Asp Lys Phe Lys Gly Thr Ser Gly Ile Asp Leu  
210 215 220  
Thr Lys Asp Lys Met Ala Met Gln Arg Leu Arg Glu Ala Ala Glu Lys  
225 230 235 240  
Ala Lys Ile Glu Leu Ser Ser Ser Gln Ser Thr Ser Ile Asn Leu Pro  
245 250 255  
Tyr Ile Thr Val Asp Ala Asp Lys Asn Pro Leu Phe Leu Asp Glu Gln  
260 265 270  
Leu Thr Arg Ala Glu Phe Gln Arg Ile Thr Gln Asp Leu Leu Asp Arg  
275 280 285  
Thr Arg Gln Pro Phe Lys Ser Val Ile Ala Asp Ala Gly Ile Ser Val  
290 295 300  
Ser Asp Ile Asp His Val Leu Val Gly Gly Ser Thr Arg Met Pro  
305 310 315 320  
Ala Val Thr Asp Leu Val Lys Glu Leu Thr Gly Gly Lys Glu Pro Asn  
325 330 335  
Lys Gly Val Asn Pro Asp Glu Val Val Ala Val Gly Ala Ala Leu Gln  
340 345 350  
Ala Gly Val Leu Lys Gly Glu Val Lys Asp Val Leu Leu Leu Asp Val  
355 360 365  
Thr Pro Leu Ser Leu Gly Ile Glu Thr Lys Gly Gly Val Met Thr Lys  
370 375 380  
Leu Ile Glu Arg Asn Thr Thr Ile Pro Thr Lys Arg Ser Glu Thr Phe  
19

385 Thr Thr Ala Asp Asp Asn Gln Pro Ser Val Gln Ile Gln Val Tyr Gln  
 405 410 415  
 Gly Glu Arg Glu Ile Ala Ala His Asn Lys Leu Leu Gly Ser Phe Glu  
 420 425 430  
 Leu Thr Gly Ile Pro Pro Ala Pro Arg Gly Val Pro Gln Ile Glu Val  
 435 440 445  
 Thr Phe Asp Ile Asp Ala Asn Gly Ile Val His Val Thr Ala Lys Asp  
 450 455 460  
 Lys Gly Thr Gly Lys Glu Asn Thr Ile Lys Ile Gln Glu Gly Ser Gly  
 465 470 475 480  
 Leu Ser Lys Glu Glu Ile Asp Arg Met Ile Lys Asp Ala Glu Ala His  
 485 490 495  
 Ala Glu Glu Asp Arg Lys Arg Arg Glu Glu Ala Asp Val Arg Asn Gln  
 500 505 510  
 Ala Glu Ser Leu Val Tyr Gln Thr Glu Lys Phe Val Lys Asp Gln Arg  
 515 520 525  
 Glu Ala Glu Gly Gly Ser Lys Val Pro Glu Glu Thr Leu Ser Lys Val  
 530 535 540  
 Asp Ala Ala Ile Ala Asp Ala Lys Thr Ala Leu Gly Gly Thr Asp Ile  
 545 550 555 560  
 Thr Ala Ile Lys Ser Ala Met Glu Lys Leu Gly Gln Glu Ser Gln Ala  
 565 570 575  
 Leu Gly Gln Ala Ile Tyr Glu Ala Thr Gln Ala Glu Ser Ala Gln Ala  
 580 585 590  
 Gly Gly Pro Asp Gly Ala Ala Ala Gly Gly Gly Ser Gly Ser Ala Asp  
 595 600 605  
 Asp Val Val Asp Ala Glu Val Val Asp Asp Asp Arg Glu Ser Lys  
 610 615 620

<210> 21

<211> 1701

<212> DNA

<213> Mycobacterium avium paratuberculosis

<220>

<223> Description of Combined DNA/RNA Molecule:  
immunogenic protein of M. avium paratuberculosis

<220>

<221> CDS

<222> (76)..(1701)

<400> 21

gcagcctggt cgtccgtcgc gggcactgca cccggccagg acgtgtcatc cccaatccgg 60

aggaatcact tcgca atg gcc aag aca att gcg tac gac gaa gag gcc cgt 111  
 Met Ala Lys Thr Ile Ala Tyr Asp Glu Glu Ala Arg  
 1 5 10

cgc ggc ctc gag cgg ggg ctc aac gcc ctc gcc gac gcg gta aag gtc 159  
 Arg Gly Leu Glu Arg Gly Leu Asn Ala Leu Ala Asp Ala Val Lys Val  
 15 20 25

acg ttg ggc ccc aag ggt cgc aac gtc gtc ctg gag aag aag tgg ggt 207  
 Thr Leu Gly Pro Lys Gly Arg Asn Val Val Leu Glu Lys Lys Trp Gly  
 30 35 40

gcc ccc acg atc acc aac gat ggt gtg tcc atc gcc aag gag atc gag 255  
 Ala Pro Thr Ile Thr Asn Asp Gly Val Ser Ile Ala Lys Glu Ile Glu  
 45 50 55 60

ctg gag gac ccg tac gag aag atc ggc gcc gag ctg gtc aag gaa gtc	303
Leu Glu Asp Pro Tyr 65 Glu Lys Ile Gly Ala 70 Glu Leu Val Lys Glu Val 75	
gcc aag aag acc gac gac gtc gcc ggt gac ggc acg acg acg gcc acg	351
Ala Lys Lys Thr 80 Asp Asp Val Ala 85 Gly Asp Gly Thr Thr 90 Thr Ala Thr	
gtg ctc gcc cag gcg ttg gtc cgc gag ggc ctg cgc aac gtc gcg gcc	399
Val Leu Ala 95 Gln Ala Leu Val Arg 100 Glu Gly Leu Arg Asn 105 Val Ala Ala	
ggc gcc aac ccg ctg ggt ctc aag cgc ggc atc gag aag gcc gtc gag	447
Gly Ala Asn Pro Leu Gly Leu Lys Arg Gly Ile Glu Lys Ala Val Glu	
110 115 120	
aag gtc acc gag acc ctg ctc aag tcg gcc aag gag gtc gag acc aag	495
Lys Val Thr Glu Thr Leu Lys Ser Ala Lys 135 Glu Val Glu Thr Lys 140	
gac cag atc gct gcc acc gcg gcc atc tcc gcg ggc gac cag tcg atc	543
Asp Gln Ile Ala 145 Thr Ala Ala Ile Ser 150 Ala Gly Asp Gln Ser 155 Ile	
ggc gac ctg atc gcc gag gcg atg gac aag gtc ggc aac gag ggc gtc	591
Gly Asp Leu Ile Ala Glu Ala Met Asp Lys Val Gly Asn Glu Gly Val	
160 165 170	
atc acc gtc gag gag tcc aac acc ttc ggc ctg cag ctc gag ctc acc	639
Ile Thr Val 175 Glu Glu Ser Asn Thr 180 Phe Gly Leu Gln Leu 185 Glu Leu Thr	
gag ggt atg cgg ttc gac aag ggt tac atc tcg ggc tac ttc gtc acg	687
Glu Gly Met Arg Phe Asp Lys 195 Gly Tyr Ile Ser Gly Tyr Phe Val Thr	
190 200	
gac gcc gag cgt cag gaa gcg gtc ctc gag gac ccg ttc atc ctg ctg	735
Asp Ala Glu Arg Gln Glu Ala Val Leu Glu Asp 215 Pro Phe Ile Leu Leu 220	
205 210 215 220	
gtc agc tcc aag gtc tcg acc gtc aag gac ctg ctg ccg ctg ctg gag	783
Val Ser Ser Lys Val 225 Ser Thr Val Lys Asp Leu Leu Pro Leu Leu 235 Glu	
230 235	
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Lys Val Ile Gln Ala Gly Lys Pro Leu Leu Ile Ile Ala Glu Asp Val	
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gag ggc gag gcc ctg tcc acc ctg gtc gtc aac aag atc cgc ggc acc	879
Glu Gly Glu Ala Leu Ser Thr Leu Val Val Asn Lys Ile Arg Gly Thr	
255 260 265	
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Phe Lys Ser Val Ala Val Lys 275 Ala Pro Gly Phe Gly Asp Arg Arg Lys	
270 280	
gcg atg ctt cag gac atg gcc atc ctc acc ggc ggc cag gtc atc agc	975
Ala Met Leu Gln Asp Met Ala Ile Leu Thr Gly Gly Gln Val Ile Ser 300	
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Glu Glu Val Gly Leu Ser Leu Glu Ser Ala Asp Ile Ser Leu Leu Gly	
305 310 315	

aag gcc cgc aag gtc gtc gtc acc aag gac gag acc acc atc gtc gag	1071
Lys Ala Arg Lys Val Val Val Thr Lys Asp Glu Thr Thr Ile Val Glu	
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Gly Ala Gly Asp Ser Asp Ala Ile Ala Gly Arg Val Ala Gln Ile Arg	
335 340 345	
acc gag atc gag aac agc gac tcc gac tac gac cgc gag aag ctg cag	1167
Thr Glu Ile Glu Asn Ser Asp Ser Asp Tyr Asp Arg Glu Lys Leu Gln	
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Glu Arg Leu Ala Lys Leu Ala Gly Gly Val Ala Val Ile Lys Ala Gly	
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gcc gcg acc gag gtc gag ctc aag gag cgc aag cac cgc atc gag gac	1263
Ala Ala Thr Glu Val Glu Leu Lys Glu Arg Lys His Arg Ile Glu Asp	
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Ala Val Arg Asn Ala Lys Ala Ala Val Glu Glu Gly Ile Val Ala Gly	
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Gly Gly Val Ala Leu Leu His Ala Ile Pro Ala Leu Asp Glu Leu Lys	
415 420 425	
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Leu Glu Gly Glu Glu Ala Thr Gly Ala Asn Ile Val Arg Val Ala Leu	
430 435 440	
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Glu Ala Pro Leu Lys Gln Ile Ala Phe Asn Gly Gly Leu Glu Pro Gly	
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Val Val Ala Glu Lys Val Arg Asn Ser Pro Ala Gly Thr Gly Leu Asn	
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Ala Ala Thr Gly Glu Tyr Glu Asp Leu Leu Lys Ala Gly Ile Ala Asp	
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Pro Val Lys Val Thr Arg Ser Ala Leu Gln Asn Ala Ala Ser Ile Ala	
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Gly Leu Phe Leu Thr Thr Glu Ala Val Val Ala Asp Lys Pro Glu Lys	
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Phe	

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<212> PRT

<213> Mycobacterium avium paratuberculosis

<220>

<223> Description of Combined DNA/RNA Molecule:  
immunogenic protein of M. avium paratuberculosis

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Lys Gly Arg Asn Val Val Leu Glu Lys Lys Trp Gly Ala Pro Thr Ile
      35      40      45
Thr Asn Asp Gly Val Ser Ile Ala Lys Glu Ile Glu Leu Glu Asp Pro
      50      55      60
Tyr Glu Lys Ile Gly Ala Glu Leu Val Lys Glu Val Ala Lys Lys Thr
      65      70      75      80
Asp Asp Val Ala Gly Asp Gly Thr Thr Thr Ala Thr Val Leu Ala Gln
      85      90      95
Ala Leu Val Arg Glu Gly Leu Arg Asn Val Ala Ala Gly Ala Asn Pro
      100      105      110
Leu Gly Leu Lys Arg Gly Ile Glu Lys Ala Val Glu Lys Val Thr Glu
      115      120      125
Thr Leu Leu Lys Ser Ala Lys Glu Val Glu Thr Lys Asp Gln Ile Ala
      130      135      140
Ala Thr Ala Ala Ile Ser Ala Gly Asp Gln Ser Ile Gly Asp Leu Ile
      145      150      155      160
Ala Glu Ala Met Asp Lys Val Gly Asn Glu Gly Val Ile Thr Val Glu
      165      170      175
Glu Ser Asn Thr Phe Gly Leu Gln Leu Glu Leu Thr Glu Gly Met Arg
      180      185      190
Phe Asp Lys Gly Tyr Ile Ser Gly Tyr Phe Val Thr Asp Ala Glu Arg
      195      200      205
Gln Glu Ala Val Leu Glu Asp Pro Phe Ile Leu Leu Val Ser Ser Lys
      210      215      220
Val Ser Thr Val Lys Asp Leu Leu Pro Leu Leu Glu Lys Val Ile Gln
      225      230      235      240
Ala Gly Lys Pro Leu Leu Ile Ile Ala Glu Asp Val Glu Gly Glu Ala
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Leu Ser Thr Leu Val Val Asn Lys Ile Arg Gly Thr Phe Lys Ser Val
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Ala Val Lys Ala Pro Gly Phe Gly Asp Arg Arg Lys Ala Met Leu Gln
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Asp Met Ala Ile Leu Thr Gly Gly Gln Val Ile Ser Glu Glu Val Gly
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Leu Ser Leu Glu Ser Ala Asp Ile Ser Leu Leu Gly Lys Ala Arg Lys
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Val Val Val Thr Lys Asp Glu Thr Thr Ile Val Glu Gly Ala Gly Asp
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Ser Asp Ala Ile Ala Gly Arg Val Ala Gln Ile Arg Thr Glu Ile Glu
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Asn Ser Asp Ser Asp Tyr Asp Arg Glu Lys Leu Gln Glu Arg Leu Ala
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Lys Leu Ala Gly Gly Val Ala Val Ile Lys Ala Gly Ala Ala Thr Glu
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Val Glu Leu Lys Glu Arg Lys His Arg Ile Glu Asp Ala Val Arg Asn
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Ala Lys Ala Ala Val Glu Glu Gly Ile Val Ala Gly Gly Gly Val Ala
      405      410      415
Leu Leu His Ala Ile Pro Ala Leu Asp Glu Leu Lys Leu Glu Gly Glu
      420      425      430
Glu Ala Thr Gly Ala Asn Ile Val Arg Val Ala Leu Glu Ala Pro Leu
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Lys Gln Ile Ala Phe Asn Gly Gly Leu Glu Pro Gly Val Val Ala Glu
      450      455      460
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Glu	Tyr	Glu	Asp	Leu 485	Leu	Lys	Ala	Gly	Ile 490	Ala	Asp	Pro	Val	Lys 495	Val
Thr	Arg	Ser	Ala 500	Leu	Gln	Asn	Ala	Ala 505	Ser	Ile	Ala	Gly	Leu 510	Phe	Leu
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Ala	Gly 530	Asp	Pro	Thr	Gly	Gly 535	Met	Gly	Gly	Met	Asp 540	Phe			